THURSDAY, SEPTEMBER 27, 1877

URBAN J. J. LEVERRIER

OUR readers will not have been altogether surprised at the announcement of the death of the Director of the Paris Observatory. We have had frequent occasion recently to refer to the unsatisfactory state of M. Leverrier's health, and only a fortnight since we announced his return to his post. He died, however, on Sunday last at the age of sixty-six years, singularly enough on the thirty-first anniversary of the discovery of Neptune.

The gigantic extent and utility of Leverrier's work has been such that it is not possible at such short notice to present anything like a worthy estimate of it. We shall therefore in the present notice content ourselves with referring to a few of the chief events in his career.

Urban Jean Joseph Leverrier was born at St. Lô, March 11, 1811. He was educated at the École Polytechnique, where he so distinguished himself as to be allowed to choose what branch of the public service he wished to enter. He selected a post under the "Administration des Tabacs," and while in that position published his first paper—a chemical one. But he soon gave up chemistry to devote himself almost entirely to mathematical astronomy. In 1839 he contributed two papers to the Paris Academy on the secular variations of the orbits of the planets. These papers attracted the attention of Arago, who requested Leverrier to calculate afresh the perturbations of Mercury with reference to the attraction of other bodies. This may be said to have been the beginning of the great work which he carried on till his death, and with which his name will be for ever associated.

The nature and the stupendous extent of this work were most admirably stated by Prof. Adams, in presenting last year to Leverrier the gold medal of the Astronomical Society. This address is referred to elsewhere. Though drawn aside for a little into the political arena by the events of 1848, he never discontinued his work in connection with the planetary orbits. While in the Legislative Assembly, as member for his native department, La Manche, he gave his attention mainly to subjects connected with public education and scientific discoveries. He has had much influence in these directions, and it is largely owing to him that the École Polytechnique has attained its present high organisation. In 1852 Leverrier was a Senator and Inspector-General of Superior Education. On the death of Arago, Leverrier, as might have been expected, was appointed to succeed him as head of the Paris Observatory. That institution he found in a most disorganised and altogether unsatisfactory condition, and Leverrier set himself earnestly to raise it to the level which it ought to occupy. A work of this kind he could not accomplish without giving offence to many interested in the continuation of the old ways. Indeed, Leverrier's rigid rule caused such discontent among his staff, that the Government were actually compelled to dismiss the great astronomer from his post in 1870; he was, however, restored again in 1873.

While Leverrier's great work was in the sphere of mathematical astronomy, he by no means neglected other departments of science connected with the work of an observatory. To him is mainly due the organisation of the existing meteorological service in France, which depends largely upon local effort. He was ever ready to afford facilities to others to carry on their own researches within the Observatory precincts, and he saw with pleasure the erection of new Observatories both in Paris itself and in the provinces.

"If on no other than selfish grounds," to quote the *Times* notice, "England, as a maritime country, cannot fail to pay a tribute of respect to a man whose work has been of the utmost practical importance in the construction of tables used in guiding ships across the seas. Nor has England been, in fact, niggardly in rendering him honour. On four occasions living words of respect and friendship from England have been addressed to M. Leverrier by presidents of the Royal Society and the Royal Astronomical Society when presenting medals, which are by tradition regarded as the highest tribute the societies can offer of their appreciation of the value of work done. In 1846 the Royal Society, under the presidency of Lord Northampton, presented to him the Copley medal. In 1848 the Royal Astronomical Society, under the presidency of Sir John Herschel, awarded a testimonial; in 1868, under the presidency of the Savilian Professor, the gold medal; and again in 1876, under the presidency of Prof. Adams, M. Leverrier's 'rival' in the discovery of Neptune, a second gold medal. Two years ago the University of Cambridge, at the suggestion of Prof. Adams, conferred on him the honorary degree of LL.D. Perhaps the most valued, because most practical, recognition that could be offered was the fact that for years past his tables have been employed in our 'Nautical Almanac,' superseding all others for the computation of the places of the planets."

Leverrier's work has been of such value to a maritime nation that a mark of appreciation on the part of our Government, as well as on the part of our societies, would not have been out of place. At the funeral on Tuesday, English science was represented by Mr. Hind, the distinguished superintendent of the *Nautical Almanac*—we hope in an official as well as in his private capacity.

M. Leverrier was Inspector-General of Universities, one of the highest dignitaries in the Legion of Honour, and a member of almost every Academy and order of merit in the world. Of his two sons one died two years ago, and the other is an engineer in the Ponts et Chaussées. Madame Leverrier has not been well for a long period, and no doubt the shock of her husband's death will tell upon her constitution.

Owing to the great loss sustained by science in the death of Leverrier, the Paris Academy of Sciences closed its session on Monday immediately after the letter from M. Tresca announcing the sad event had been read. M. Tresca was able to state that the great life-work of Leverrier had just been completed.

RECENT BOTANICAL BOOKS

Text-book of Structural and Physiological Botany. By Otto W. Thomé. Translated and Edited by Alfred W. Bennett, M.A., B.Sc. (London: Longmans, Green, and Co., 1877.)

THERE is a manifest want at the present time of a text-book of moderate size which would supply English students with a general view, not running too far into details, of the distinct types of organisation existing in the vegetable kingdom. Such a book should, as far as possible, draw its illustrations from plants which the teacher could without any very great difficulty place before his pupils. After intelligently comparing the descriptions with as many of the structures described as opportunity afforded, a student should have a tolerably clear idea of the leading facts in the comparative vegetable physiology and morphology of plants. Sachs's "Text-book" is a perfect mine of information of the most accurate and recent kind on all manner of special points, but it is rather a book for the advanced student to consult than for the beginner to study. It is often difficult in it "to see the wood for the trees," to keep well in view the firm grasp of fundamental principles of organisation which the distinguished author undoubtedly possesses, but which the richness of the materials that he has on the whole so ably marshalled cannot, especially on a first reading, but very considerably obscure. Huxley and Martin's "Elementary Biology" is undoubtedly very useful for first breaking ground, but the vegetable types are of course treated in relation to the animal and with the view of bringing out certain general laws applicable to the whole of organised nature. The commencing botanist of course wants something more specialised than this, and for a long time past there has been perhaps little better in English than the able and philosophical sketch of the vegetable kingdom which is contained in the opening chapter of Dr. Carpenter's "Comparative Physiology."

At first sight it seemed as if the desideratum had been supplied by Thomé's "Lehrbuch der Botanik," of which an English translation has recently been published by Mr. A. W. Bennett. An examination of its pages is, however, disappointing. There is an entire want on the part of the author of any definite grasp of his subject, and this, combined with a good deal of vagueness and inaccuracy in the facts, preclude the book being regarded as possessing any higher value than a mere compilation which is only not very bad because recourse has been had to fairly good sources of information. All through there are evidences that the author has not a practical familiarity with the subject on which he is writing. A few instances will suffice to illustrate this defect. On p. 10 we are told "Protoplasm . . . which is inclosed in a cell-wall has . . . no power of escaping from its envelope;" but the author confutes himself on p. 284 by stating *à propos* of Myxomycetes: "The germinating spore, now provided with a cell wall, allows the whole of its protoplasmic contents to escape." On p. 24 there is the extraordinary statement that in some *Muscineæ* starch-grains "are points of crystallisation around which the mass of chlorophyll has been deposited." And a little further on, speaking of the chlorophyll corpuscles of *Metzgeria*, we are told "They multiply also by division, splitting up into two new bodies, each capable of independent life;" yet chlorophyll-corpuscles are incapable of life independent of the cell of which they are specialised constituents. On p. 29 it is stated that the "purpose of the formation of starch is that it may be stored up in the cells as a reserve food material," which is about as just a view of this important process of nutrition as if we were to say of wheat that the purpose of its cultivation was to fill granaries. After this we may pass over as comparatively unimportant, the queer statement that starch is "deposited in especially large quantities in . . pollen-grains" of all things in the world.

On p. 32 we are told that cell-division commences by "the protoplasm . . . contracting into a spherical form." The figure on the opposite page tacitly corrects this error.

On p. 44 we learn that "*Periderm* consists of tabular cells with thicker walls, which, when looked at vertically, have a regular polygonal or stellate appearance." This is far from clear, and certainly not universally true. On p. 52 we are informed:—

> "The laticiferous vessels and the true vessels together have been compared to the venous and arterial blood-vessels of animals; but since a direct connection between them has not been proved, and the mature vessels are normally filled with air, this comparison cannot be maintained."

In an educational book surely we may ask that the *débris* of effete hypothesis should be left to slumber in its appropriate oblivion. Any one who has ever examined students will shudder to think how often this quaint relic of the phytotomy of two centuries ago will be trotted out triumphantly when far more important things are altogether forgotten.

Passing over the histology—the treatment of which cannot be regarded as satisfactory—we find a section on "The external form of plants" which, under this apparently philosophical heading, simply conceals the old dreary sterility of the descriptive terminology of flowering plants. Even this is wanting in accuracy. Thus, to take a single page (79): "scandent" is given as a synonym of twining, the fact being that it includes every form of climbing *except* twining; again, Solomon's seal is said to develop its flowering stems from terminal buds, while it is obvious that they are axillary, and therefore lateral.

The "Special Morphology" is far better planned, and if thoroughly revised and published separately, might make —as it is well-illustrated, though chiefly with borrowed woodcuts—a handy little text-book. There is the same want of severe accuracy, however, to the confusion o students. Thus (p. 192), the suspensor in phanerogams is termed the pro-embryo; p. 315, the same term is applied to the prothallus of ferns; the structures, of course, are morphologically in no way homologous. Merely to mention defects as they catch the eye in turning over the pages, on p. 274, ascospores are said to be contained in perithecia, oblivious of the asci; p. 275, saprophytic fungi are mentioned when saprogenous are intended; p. 296, *Hepaticæ* are said to form "a beautiful transition from the Thallogens to the Acrogens," which only shows how easily persons may be deluded by mere "adaptive" characters; on p. 309 the author confuses—which is almost incredible—the vascular bundle-sheath with the sclerenchyma in the fern-stem; p. 337, the North American *Callitris* is mentioned, North African being intended, and the two-lobed anthers of *Taxineæ* are mentioned, when *Taxus*, for example, has usually a six-lobed anther, as he tells us on p. 336.

We have not examined very critically the concluding chapters on Fossil and Geographical Botany, but the latter, at any rate, seems too vague to be very useful.

Altogether, we cannot but feel sorry that Mr. Bennett has spent his labour on a work of such little real value. He seems, indeed, to have had some misgivings as to its shortcomings, and has largely borrowed from Huxley and Martin's "Elementary Biology." Thus the student is left as best he may to harmonize Thomé's account of the antheridium of Characeæ, on p. 293, with Huxley's independent description on p. 294, which is transferred almost bodily.

It can hardly be doubted that Mr. Bennett, with his experience as a teacher, could have supplied us from his own pen with a text-book which would have been much more useful.

OUR BOOK SHELF

Natural Geometry; an Introduction to the Logical Study of Mathematics, for the Use of Schools and Technical Classes, with Explanatory Models. By A. Mault. (London: Macmillan, 1877.)

THIS is a good elementary text-book, founded on the work by M. E. Lagout ("Takimetry"), which we have already noticed (NATURE, vol. xvi. p. 226). The ground covered by the work before us is not quite so extensive in one direction as that covered by Dr. Gwynne's translation; but it has an introduction to pure geometry which is likely to be of service to junior pupils. We are disposed to think that some such practical training as that indicated here, with the aid of the accompanying models, and a short course of "practical" geometry would be a capital thing for our junior pupils. Boys who are exceedingly dull and stupid over their "Euclid" often, as we have repeatedly seen, take much interest in these concrete exhibitions of geometrical truths. The book has been very carefully got out; there are a few loose expressions which might be improved. On p. 32 is the statement, "in equal circles equal arcs are those which have equal chords," a distinction should be made between major and minor arcs. Another trifling matter (but some boys would at once notice it) is that some equilateral figures are drawn on p. 33, which are not equilateral by scale. There are two parts—geometry by sight, which treats of the measurement of flat surfaces and of solids, and scientific geometry, or reasoning helped by sight. The latter is concerned with the measurement of accessible and inaccessible things and with the incommensurable (as the circle, sphere, cylinder, and cone). We can recommend the book for school use.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*

The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.]

The Cycle of Sun-spots and Rainfall

MAY I venture to ask insertion for the following remarks on the cycle of sun-spots and rainfall? I frequently receive inquiries regarding the meteorological aspects of the Indian famine and the prospects of Madras during the coming monsoon. But I beg to state that the object of my investigations is not at present to predict the future, but simply to ascertain the past, facts. When we are quite sure of the data it will be time enough to apply them. In order to secure a stable basis it has been necessary to work up a vast accumulation of meteorological returns which have never been previously collated, and to make further references to India, Germany, and America. Some time must still elapse before the results can be presented as a whole. Meanwhile I should be obliged if you would give insertion to the facts with regard to two points which seem at present to have a special interest to the public.

In the first place, I think I may now safely say that the coincidence of the cycle of rainfall with the sun-spot period is not confined to Madras, but is common to various points around the great ocean tract on which Madras lies. The three such points of observation for which materials exist during the most considerable period of years are Madras, Bombay, and the Cape of Good Hope. I have made up the following table from the monthly, and, when available, from the hourly, returns of these stations; and as there are a few errors (probably clerical) in a return recently given for Bombay by the meteorological reporter at Calcutta, I ought perhaps to add that these returns have been tested by a trained computator in the Scottish Meteorological office. The sun-spot column was worked out from an old list, the only one available to me in India, and will hereafter be revised from the more complete returns issued this year by Dr. Rudolph Wölf. The differences do not, however, affect the general results. My cycle of eleven years starts back from 1876; and the *minimum* group of my cycle, namely, the eleventh, first, and second years, include all the years of *minimum* sun-spots from 1877 to 1810. It will be seen that the coincidence in the cycle at Madras and the Cape of Good Hope is very strongly marked, while that at Bombay is less so, and somewhat lags behind the other two. An explanation exists for this, but it would trespass too much on your space to enter into that side of the question.

TABLE I.—*Eleven Years' Cycle of Rainfall and Sun-spots shown in Periods of Two Years.*

	Average of rainfall in inches, registered at Madras. (1813-76.)		Average of rainfall registered at Cape of Good Hope. (1842 70.)		Average of rainfall registered at Bombay. (1817-76)		Average relative number of sun-spots (Wölf's old list). (1810-60.)	
Min. group. Eleventh series of years in the cycle of eleven years ...	37·03	Av. 40·39	21·19	Av. 21·05	70·32	Av. 68·78	10·92	Av. 10·32
Min. group. First and second series of years in the cycle of eleven years	42·07		20·98		68·02		10·02	
Third and fourth series of years in the cycle of eleven years ...	49·12		23·92		67·36		39·89	
Fifth and sixth series of years in the cycle of eleven years ...	54·64		28·11		71·22		73·44	
Seventh and eighth series of years in the cycle of eleven years	52·36		27·80		79·34		53·78	
Ninth and tenth series of years in the cycle of eleven years ...	49·02		23·26		76·42		33·54	
Eleventh series of years in the cycle of eleven years	37·03		21·19		70·32		10·92	

The cyclic coincidence may be tested in another way. If it really exists there should be a well-marked minimum group at the extremities of the cycle (in the eleventh, first, and second years), and a well-marked maximum group in the middle of the cycle (the fifth and following years). The years on both sides of the central maximum group, *i.e.*, between it and the minimum group at the two extremities, should yield intermediate results, and, when taken together, should form an equally well-marked intermediate group. I therefore divided the cycle (so far as the number 11 permitted) into three equal groups. The "minimum group" is formed by the three series of years at the extremities of the cycle, which include *all* the years of minimum sun-spots in this century from 1810 to 1877. The "maximum group" embraces the four central years from the true maximum year of the rainfall and sun-spot cycle (the fifth) to the second maximum in the sub-cycle of sun-spots in the eighth year. The "intermediate group" consists of the two series of years on both sides of the central maximum group, namely, the third and fourth years on the one side, and the ninth and tenth years on the other side.